



CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

Name(s) Christina An	Project Number S0602
Project Title Building and Testing a Magnetic Multilayered Hydrogel Microsphere Crosslinked by Genipin for Targeted Delivery of Drugs	
<p style="text-align: center;">Abstract</p> <p>Objectives The magnetic targeted drug delivery system is one of the most promising strategies for delivering highly potent drugs, like the ones used in chemotherapy, to a specified site. Magnetic microspheres were developed to overcome two major problems encountered in drug targeting: reticuloendothelial system clearance and target site specificity. A magnet, placed outside the body, is directed to the target site. The magnet can be a rod-shaped permanent magnet of any size or can be contained in equipment that looks like an open magnetic resonance imaging scanner. The loaded microspheres are introduced into a blood vessel, and in as little as half an hour, they gather at the target site to emit drugs. This research project is a continuation of a project that focused on creating multi-layered microspheres through crosslinking with genipin.</p> <p>Methods Creating the individual spheres involved vortexing and cooling gelatin with olive oil and cyclopentasiloxane. Crosslinking the spheres with gelatin allows distinct layers to be formed. Magnetizing the microspheres involves infusing magnetite, Fe₃O₄, into the gelatin for the outer layer. The characteristics and the decay rate of each microsphere was studied using a microscope. The microspheres in this experiment has magnetite on the outer layer which means if a drug was actually used, it can be infused with nanoparticles into the layer inside.</p> <p>Results The decay rate of these microspheres were studied under three different pH levels: 2, 5, and 7.4. The lower the pH value in medium is, the faster the drug release from the microspheres. Although, the magnetization curve of the microsphere was less dramatic than the curve for pure magnetite, it still showed that the microspheres were able to be magnetized. The success rate of each layer went down after adding magnetite. This year's experiment was also able to improve upon the process of crosslinking through incubation.</p> <p>Conclusions Future research would involve using a multilayered magnetic microsphere with actual drugs and in in vivo research. A focus on how to prevent a premediated release of the drugs might involve looking for new materials or chemicals to bring in to the method. After gaining more data, the use of the Higuchian model to develop a mathematical analysis for decay is proposed. This experiment proved that magnetization of the outer layers of a microsphere is possible.</p>	
Summary Statement The purpose of my experiment was to create magnetized microspheres with multiple layers to increase the possibility of the targeted delivery of drugs in a multi-step medication process.	
Help Received I was able to receive access to a lab facility to continue my experiment.	